Proceedings of "National Conference on Emerging Trends in Science and Advances in Engineering"
Organized by Phaltan Education Society's College of Engineering Phaltan, www.coephaltan.edu.in
International Journal of Innovations in Engineering Research and Technology [IJIERT]
ISSN: 2394-3696, Website: www.ijiert.org, July, 2023

Weedinator- Weed Identification and Removal Using Image Processing

[1]Ms. Dipali D. Jadhav
Assistant Professor, Department of E&TC Engineering, PESCOE, Phaltan, Maharashtra, India
dipalijadhav12@gmail.com
[2]Mrs. Pallavi S. Jadhav
Assistant Professor, Department of E&TC Engineering, PESCOE, Phaltan, Maharashtra, India
pallavichavan30@gmail.com
[3]Ms. Mayuri G. Khandalkar
Assistant Professor, Department of E&TC Engineerin, PESCOE, Phaltan, Maharashtra, India
mayurikhandalkar@gmail.com
[4]Mr. Anup B. Kumbhar
Assistant Professor, Department of E&TC Engineerin, PESCOE, Phaltan, Maharashtra, India
kumbharanup.18@gmail.com

Abstract –

Agriculture is facing crisis in terms of production due to unwanted weed among the crops. The main objective of this work is a weed control system that differentiates the weed from crops and restricts weed growth alone by the precise removal of it. This is implemented in real time by capturing the images of the field at regular intervals and processing them with a Raspberry Pi board by making use of an image processing algorithm to differentiate the desired plants from the weeds. This is based on features like color and size of the crop and weed. Once the weeds are identified and located correctly through image processing, a signal is transmitted from the Raspberry Pi board to turn on the weed cutting system and spraying herbicides for required area only.

Index Terms: Agriculture, Crop, Image Processing, RaspberryPi, Weed Detection, Weed Removal.

I. INTRODUCTION

In olden days weed detection was done by employing some men, especially for that purpose. They were detecting the weed by checking each and every place of the field. Then they were plucking them out manually using their hands. But to detect the weeds they were still using manual power. Then they started using image processing for this purpose. In this proposed system our main aim is to detect the weed in the crop by using image processing as shown in figure 1.

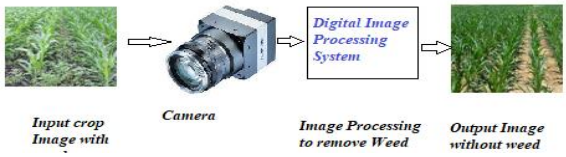

Fig 1: Proposed system

This system is implemented on Raspberry Pi for real time use. Here the identification and removal of weeds are performed through image processing. The weed management system performs image acquisition from the field. Image processing is then performed in the Raspberry Pi board using Open source Computer Vision which is a library of pre-written functions. An appropriate algorithm for weed detection is developed. Based on the results, the activation of the weed removal mechanism is controlled.

II. RELATED WORKS

The automatic weed detection and smart herbicide sprayer robot developed in [1] uses an image processing algorithm toprocess the images captured by the Raspberry Pi Camera at regular intervals and upon identifying the weeds, anarrangement is made to spray the herbicide directly and onlyon the weeds. In [2], Ajinkya Paikekari *et.al* implemented weed removal by spraying herbicides only in the areas where weed is present. The system detects and separates out the weed affected area from the crop plants in an image taken from the fields by using MATLAB to implement imageprocessing.

The system implementation of an image processingtechnique for weed detection and removal is introduced in [3].It involves simple edge detection techniques using various filters like the Gaussian filter and Laplacian filter. After certain steps, an output image is obtained where the weeds are separated from the crop. In paper [4], Amir H. Kargar B *et.al* developed a weed detection andclassification method that can be applied for autonomousweed control robots. The acquired images are processed in the LabVIEW environment to find locations of weeds in theimage. Finally, herbicides are sprayed on desired spots.

III. PROPOSED SYSTEM

This work aims to develop an automatic system for weed detection and removal based on image processing in Raspberry Pi. The block diagram of the proposed system is shown in figure 2. In this proposed system, IR sensor will detect the obstacle and then Pi will capture crop image in the field. In Raspberry Pi, this captured image is processed to identify the weed. Mechanical Assembly unit contains different processes like weed removal, wheel motor rotation, cutting tools operation and battery switching system. If weed is detected, then weed cutting is done with the help of cutting mechanism. If weed

is too small to cut then herbicide spraying will be activated. Then system will continuously work through the field to detect and remove the weed.

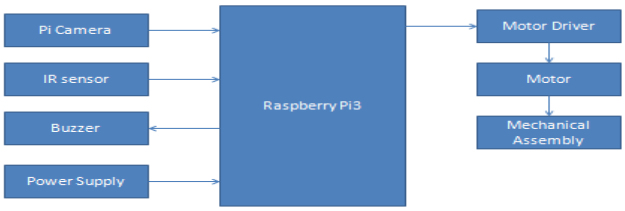

Fig 2: Block Diagram of the Weed Detection andRemoval System

IV. IMPLEMENTATION

A. *Work Flow*

The workflow of the system is shown in the figure 3.

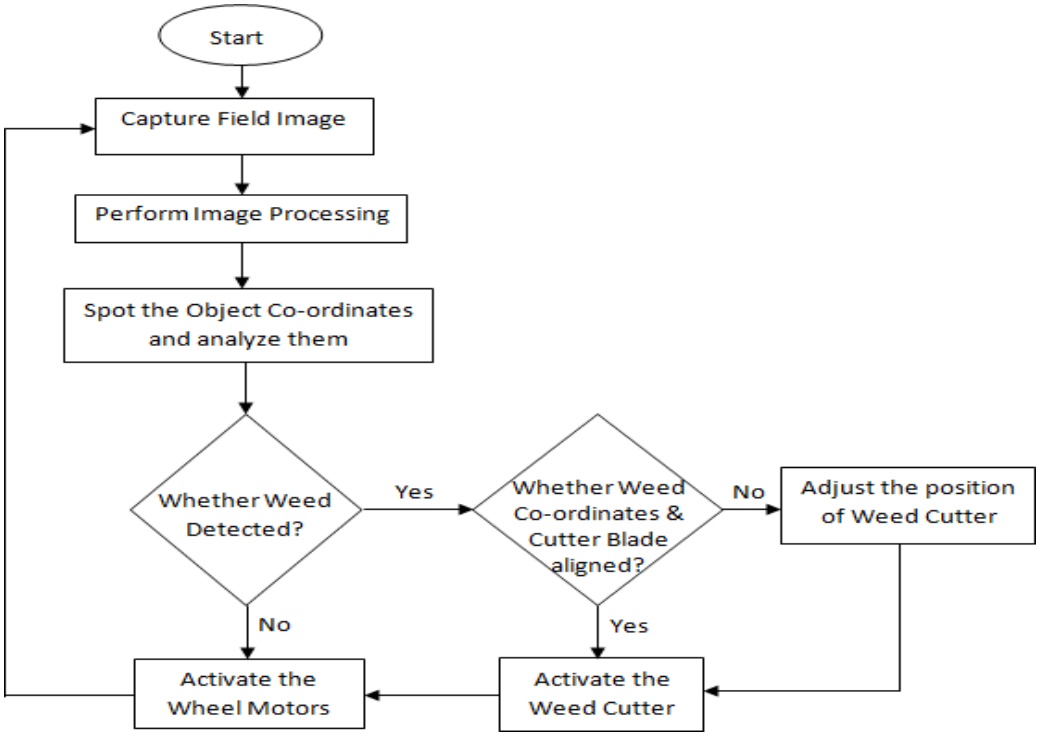

Fig 3: Flow chart

B. *Image Processing Algorithm*

The field image captured is processed by the Raspberry Pi board. The image passes through various stages of processing. Initially, image pre-processing is performed to suppress unwanted distortions and to enhance some image features important for further processing. The pre-processing stages include blurring, colour space conversion, masking within a range, erosion and dilation.

Step 1:	Image pre-processing
Step 2:	Find contours of entire plant region
Step 3:	Obtain co-ordinates of plant region from contour values
Step 4:	Bound the contours using rectangles and number them
Step 5:	Consider each bounded area and analyze the co-ordinate values to determine size
Step 6:	Classify contours on lower half with smaller size as weeds and those on upper half and larger size as crops
Step 7:	Check if there is enough space between the co-ordinates of classified weed and crop
Step 8:	Confirm the presence of weed when criteria in step 6 & 7 are met
Step 9:	Use the confirmed weed's co-ordinates for alignment of weed cutter

C. Hardware Setup

The entire system is mounted on a four-wheeled robot. Thestructure comprises of aluminum chassis and wheels with geared motors are attached to the robot for movement as shown in figure.4

Fig 4: Overall System Implementation

The weed cutter is moved from the base position to the crop row upon identifying weed as a result of image processing. To implement this movement rackand pinion arrangement is made. When the weed cutting motor is activated by the signal from Raspberry Pi board, the blade attached to the motor shaft rotates at very high speed causing the weed in the region tobe cut off.

V. RESULTS

A sample weed is taken in front of raspberry Pi camera. Image capturing is performed by Pi Camera to detect weed as shown in figure 5**.**

Fig 5: Weed Image Captured by robot

The captured image then goes through different stages of processing like blurring, colour space conversion, thresholding, erosion and dilation to detect the presence of weed. The final result of the various images processing stages is shown in Fig.6.

Fig 6: Image after Processing

Figure 6 shows the final result after detecting weed the cutting action has been taken on that weed using cutting mechanism.

CONCLUSION

Automatic weed detection and removal based on image processing addresses this issue. The proposed system for weed management is set up on a four-wheeled robot. The systemis deployed in the field where crop is cultivated row- wise. The robot movement in the real field can be achieved. Colour images with required quality are obtained from the field using Pi Camera. Images are captured sideways, unlike the usual practice of taking the top view of plants. Image processing focuses on the plant size and colour rather than their shape and is done by the Raspberry Pi board. Weeds growing among the crops are detected successfully. The alignment of cutter and its activation based on the image processing result is also carried out efficiently.

ACKNOWLEDGEMENT

We would like to express our deepest appreciation to all those who provided us the possibility to complete this project. A special gratitude we give to our Principal Prof. Dr. N. G. Narve, whose contribution in stimulating suggestions and encouragement, helped us to coordinate this project.

REFERENCES

[1] Aravind R, Daman M, and Kariyappa B. S., "*Design and Development of Automatic Weed Detection and Smart Herbicide Sprayer Robot*," IEEE Recent Advances in Intelligent Computational Systems (RAICS), Trivandrum, Dec. 2015, pp. 257-261.

[2] Ajinkya Paikekari, Vrushali Ghule, Rani Meshram, and V.B. Raskar, "*Weed Detection using Image Processing*," Int. Res. J. of Engg. & Tech. (IRJET), vol. 3, no. 3, Mar. 2016, pp. 1220-1222.

[3] R. Anirudh Reddy, G. Laasya, T. Sowmya, P. Sindhuja, and Mudasar Basha, "*Image Processing for Weed Detection*," Int. J. Engg. Tech., Mngmt & Applied Sci.(IJETMAS), vol. 5, Apr. 2017, pp. 485-489.

[4] Amir H. Kargar B, and Ali M. Shirzadifar, "*Automatic Weed Detection System and Smart Herbicide Sprayer Robot for corn fields*," Proc. 2013 RSI/ISM Int.Conf. Robotics &Mechatronics, Tehran, Feb. 2013, pp. 468-473.

[5] G. Y. Rajaa Vikhram, Rakshit Agarwal, Rohan Uprety and V. N. S. Prasanth, "*Automatic Weed Detection and Smart Herbicide Sprayer Robot*," Int. J. Engg. & Tech., 2018, pp. 115-118.

[6] Riya Desai, Kruti Desai, Shaishavi Desai, Zinal Solanki, Densi Patel, and Vikas Patel, "*Removal of weeds using Image Processing: A Technical Review*," Int. J. Adv. Comp. Tech. (IJACT), vol. 4, no. 1, pp. 27-31.

[7] Amruta A. Aware, Kavita Joshi, "*Crop and Weed Detection Based on Texture and Size Features and Automatic Spraying of Herbicides*," Int. J. Advanced Research in Computer Science and Software Engg., vol. 6, no. 1, Jan. 2016, pp. 344-350.

[8] A Book by Rafael C. Gonzalez and Richard E. Woods, "*Digital Image Processing*", 3rd edition.